Making and Un-making meat: Cultural boundaries, environmental thresholds and dietary transgressions[1]

Colin Sage

Forthcoming as Chapter nine in Goodman, M and Sage, C. (eds) *Food Transgressions: Making sense of contemporary food politics*. Farnham, UK: Ashgate.

Introduction

It is generally acknowledged that the human species evolved as omnivores, physiologically and culturally adapted to eating a wide range of foods, including those of animal origin. However, the past five decades have witnessed a marked '*meatification*' of the human diet, spreading from long-established high-consumption societies to the 'emerging market economies' of Asia and Latin America which have been undergoing a 'nutrition transition' (Weis 2007, Popkin 2005). As Carolan states, "eating large quantities of meat has become a cultural imperative throughout much of the world, having become a sign of affluence and modernity and a 'right' of consumer choice" (2011: 84). Moreover, nutritional orthodoxy generally attributes population health gains to increased consumption of meat and other livestock products which are important sources of protein, energy, vitamins and minerals, and therefore regarded as a remedy for global malnourishment (Neo 2011). Yet there is growing concern around the extent to which this process of global dietary convergence featuring high levels of meat consumption is having a detrimental effect on human and environmental health (Friel et al 2009, Cannon 1999).

Indeed, the apparently insatiable human appetite for meat has begun to raise important questions about limits: what is an acceptable level of consumption that satisfies nutritional requirements without compromising individual or ecological health? What are the wider moral parameters of satisfying our hunger for this profoundly elemental food source as cheaply as possible when it has such profound repercussions for other species and for future generations of our kind? As we shall

[1] My particular thanks to Mike Goodman for his advice and support in writing this paper. However, all shortcomings are my responsibility alone.

see, such questions pose others in turn: does a minimum threshold that satisfies dietary need adequately fulfil cultural or material expectations? And if rising economic prosperity has almost universally come to mean rising levels of meat intake, how should this relationship be decoupled in rapidly growing economies where industrial meat production is taking hold?

What this chapter is about

Since the publication of Livestock's Long Shadow (Steinfeld et al 2006) there has been increasing attention given to the environmental consequences of the rising farm animal population worldwide, in particular its contribution through greenhouse gas emissions to global climate change (cf Garnett 2009, Stehfest et al 2009, Nordgren 2012, Sage 2012a). At the same time, other work has sought to explore awareness of eating practices involving animal-derived foods and how these are shaped by consideration of environmental or animal welfare concerns (cf Cole et al 2009, Miele and Evans 2010, Evans and Miele 2012). Gradually, a body of work has emerged that problematises meat consumption practices and seeks to explore options for lowering demand for animal products in high-income countries. The challenges are considerable, not least because our societies appear to be 'locked-into' consumption patterns that benefit from positive feedback despite the persistence of negative health and environmental outcomes (Frank 2007).

This chapter briefly summarises some of the key issues surrounding rising numbers of intensively-reared livestock and the consequently high levels of meat consumption in the rich North. Meat is, and has long been, a deeply culturally embedded food, although the quantities consumed in the North and, increasingly across the rapidly developing economies of the Global South, are quite novel. While there is a case that societies in the South should have room to increase consumption as a means to alleviate malnourishment, it is clear that in the North aggregate levels should fall significantly – by at least 30 percent - in the interests of environmental and human health. However, this is unlikely to be achieved by making appeals to eating less; appeals that are likely to be rejected as contravening the basic principles of consumer sovereignty. Thus the chapter sets out to explore possible alternative pathways of *de-meatification* recognising that each possesses different transgressive qualities that challenge many prevailing cultural and societal norms. How, for

example, are campaigns for meatless days regarded by those who unreflexively consume meat products and where the animal origins of such foods simply do not figure? What role might be played by celebrity chefs in leading a cultural revolution against meat-dominated meals? And what are the prospects for industrial alternatives to animal bodies as providers of meat and meat analogues? While this chapter is unable to provide answers to all these questions, it highlights the culturally transgressive nature of such innovations and contributes to the developing debate surrounding meat production and consumption practices.

Livestock, meat and environmental thresholds

The global food industry has arguably been built upon a pillar of meat, comprising beef in the bun, pork in the roll and chicken in the nugget. Meat production has tripled in volume worldwide since the 1970s; it has grown by more than one-fifth since 2000; and it is expected to double by 2050 (FAO 2009). Per capita meat consumption now averages 41.2 kg per year, up from 30 kg in 1980. However, there remains considerable disparity across the world: in India just 5.8kg of meat are eaten per person per year whereas the USA accounts for almost 127 kg per person. Consumption of animal products, including milk and eggs, has grown most quickly in China where around 60 kg of meat are consumed annually per capita, a rate that has grown by four times since 1980 and by 50 percent since 1995 (FAO 2009). Underpinning all of this, of course, are farmed animals, principally cattle, pigs and chickens that together account for 88 percent of all animal flesh by volume (Weis 2007). In 2005 more than 55 billion farm animals were slaughtered a more than five-fold increase in four decades. Today more than 40 percent of all meat production worldwide is produced by factory farms, a production model that illustrates the almost complete globalization of the industrial grain – livestock complex (Weis 2007).

Given rising per capita demand for meat worldwide, consequences arising from its provision are coming under increased scrutiny from a variety of different perspectives. Amongst the key areas of concern highlighted within the recent literature regarding the intensification of animal production and meat consumption are the following:

1. Global meat consumption has been estimated at 228 million tonnes (FAO 2009) and is expected to double by 2050 to 465mt. Given that livestock currently account for 40% of global grain production by 2050 livestock will be consuming food that could feed 4 billion people directly (Carolan 2011). The conversion of plant to animal protein is inefficient; livestock consume 77 million tonnes of protein in feedstuffs that could potentially be used for human nutrition, whereas the products that livestock supply contain only 58 million tonnes of protein. In dietary energy terms, the net loss is even higher (Steinfeld et al 2006; Pimentel and Pimentel 2003), with meat supplying just 15 percent of all calories (Stokstad 2010). With food prices on an upward, if highly volatile, trend it is becoming critical to consider how meat consumption interacts with global food security.

2. Meat and dairy products are the foods carrying the greatest environmental burden (Garnett 2009; Tukker et al 2006). Livestock are estimated to account for around 37 percent of anthropogenic methane, 65 percent of nitrous oxide and 9 percent of carbon dioxide, that together constitute 18 percent of all greenhouse gas emissions, a share greater than the transport sector worldwide. Robert Goodland has conducted a calculation incorporating land set aside for both livestock and for feed production and estimated that livestock account for as much as 51% of human-induced GHG emissions (Goodland and Anhang 2009). Livestock-induced land use change is estimated to generate 2.4bt of CO2 per year, representing around 7 percent of global greenhouse gas emissions (Garnett 2009). Given the prevailing scientific understanding of the need for abatement measures that would avoid serious climatic perturbation, how are we to achieve stabilisation of the global climate system if animal numbers grow further? Intensive livestock farming also gives rise to other significant waste streams to air (eg ammonia), land and water resulting in loss of environmental quality (CIWF 2008). In the Netherlands, for example, it has been estimated that livestock produce 4,000kg of manure for every human inhabitant, resulting in acidification, eutrophication and contamination of surface and ground water (Aarts et al 2010).

3. The meat and livestock sector has come to exemplify Fordist production processes with emphasis placed on rising volumes and faster throughput. This has involved a scaling up of production represented by stocking densities, as well as a speeding up of animal metabolisms through breeding practices that shorten life-

spans before animals achieve market weight (Emel and Wolch 1998). Rising concerns over animal welfare has brought such practices under the spotlight, but has also led the food industry to develop more ‘animal friendly’ lines (Miele 2011).

4. Stocking densities and feeding practices, including the use of sub-therapeutic doses of antibiotics to inhibit the spread of disease, have contributed to the resurgence of communicable diseases in recent decades, three-quarters of which are attributable to animals and animal products (Hinchcliffe et al 2012). Episodes such as BSE in cattle, salmonella in eggs, e. coli in hamburgers, and outbreaks of swine and avian influenza have heightened anxieties over the biosecurity of livestock farming and the safety and integrity of meat products.

5. Levels of meat consumption in the developed countries have been high and growing steadily for several decades, aided by an ever greater array of products to eat within or outside the home, and in real terms at lower prices. Yet growing clinical evidence has demonstrated the problematic association of diets high in saturated fats with obesity, cardio-vascular disease, hyper-tension and cancer (Friel et al 2009).

It is as a result of the complex interaction of these issues that has led growing numbers of organizations and individuals, including celebrity chefs, to reflect upon the practices of meat consumption and production and the way these might be changed (cf. *Jamie Saves Our Bacon, Hugh’s Chicken Run*). While this is not to suggest large numbers are making a conversion to vegetarianism, there has been a marked increase in purchases of products certified as animal welfare-friendly (eg Freedom Food). This testifies to ways in which the ‘moral turn’ affecting food consumption practices more broadly (Goodman, et al 2010) is challenging the primacy of meat on the plate. This is giving rise to a number of interesting social and technical innovations, which the second part of this chapter will explore. First, however, it is necessary briefly to review how meat has come to occupy such a central position in contemporary diets and given rise to the global grain-livestock-meat complex.

The *Meatification* of the Human Diet

The consumption of animal flesh is surrounded by taboos, comprising outright prohibition or socially sanctioned norms about what is acceptable to eat. In the Islamic world strict dietary laws prohibit the consumption of pork, blood or the meat of any animal not slaughtered according to the code of *halal*. For Hindus the slaughter of a cow constitutes a major transgression of religious norms and of Indian federal law, although this has not prevented the country from becoming the world's largest exporter of beef, as we shall see. Cultural acceptability has meant that horse meat remains popular in Northern Italy, France and Japan, but there is a strong aversion in Ireland and the UK where recreation with equines makes them a companion species rather than a food source. Guinea pigs, a frequent ingredient of a stew in highland Bolivia and Peru, are regarded as children's pets in the UK. But this is as nothing compared to the revulsion felt by much of the Western world about the eating of dog, which remains on the menu in China and South Korea (Davidson 2006). The species of an animal consequently constitutes a fundamental cultural boundary as regards its acceptability as a source of meat.

Moreover, if cooking is truly the rendering of 'raw nature' into culture, as Lévi-Strauss observed, there are sharp differences around the application of heat to meat. Steak tartare and carpaccio (of horse or beef) are examples of raw meat served finely cut in western cuisine, while many like their steaks to be done 'rare' when eating in restaurants. The oozing of blood from fibres along the line of cut may be relished by the diner, but may be treated with horror by their dining companion who may have requested their meat to be 'well done'. There is a carefully constructed sensibility around rawness in these contexts, perhaps mediated by starched napkins, sauces and seasoning; features that were visibly absent when I was drinking in a pub in Addis Abbaba a few years ago and watched fellow drinkers at an adjacent table use sharp knives to cut slices from a large raw hind of beef. Across these diverse contexts we can appreciate that meat is a deeply culturally embedded material, connecting us with a distant past and with powerfully engendered associations, as the male fascination with cooking over an open flame (aka a barbecue) testifies (Buerkle 2012).

But to argue that animal foods – whether scavenged, collected, hunted or produced from domesticated species – have been a universal feature of human behaviour is not to assert their universal primacy as a source of nutrition. Livestock products do provide an important source of protein, minerals such as iron and calcium, and vitamins including B12; but also large quantities of saturated fat that are directly linked to heart disease. Most stable agrarian societies of the past – as opposed to pastoralists - ate relatively little meat, with most nutritional needs supplied by a starchy staple (comprising a cereal or tuber) together with a legume (as in rice and beans, tortilla and beans, chapatti and dhal etc) that combine to provide complementary amino acids (Mintz and Schlettwein-Gsell 2001). Yet the dominant nutritional message emerging from the global development agencies is that the rural poor of the present day are not consuming enough animal-based food given the high incidence of nutrient deficiencies, such as iron (FAO 2009). Given the vital multifunctional role played by animals (for draught, milk, wool) few are slaughtered as a source of fresh meat, and this generally confined to ritual occasions. For the rural poor, animal proteins are consumed as fermented or preserved products in modest quantities and as fringe components of the starchy core (Mintz and Schlettwein-Gsell 2001).

Without seeking to romanticize indigenous culinary traditions evidence does suggest that most were remarkably effective in providing a balanced - if not especially varied - diet and that the deteriorating nutritional status of many rural societies today is as a result of the displacement of mixed farming with market-oriented monocultures. Little wonder that the expansion of the global food economy which has done so much to transform dietary patterns has come to associate meat consumption with progress, wealth and status. As countries become more integrated into the world economy dietary patterns converge with “increased consumption of meat and meat products, dairy products, edible oil, salt and sugar, and a lower intake of dietary fibre” (Hawkes 2006: 3). And it would appear that this vital role of meat in dietary change and its positive associations with improved prosperity were developed first and most powerfully in the United States and from where this experience has served to become a generalised model.

According to Horowitz, who traces the history of meat consumption in the United States, regardless of “regional, ethnic or racial variations, as incomes rose so did the

demand for beef and poultry" (2006: 11). Indeed, across the nineteenth century average annual consumption of meat was of the order 150-200 lbs per person (68 – 91kgs). Meat consumption then fell to unusually low levels during the Great Depression, according to Horowitz, but recovered during the 1940s though remained sharply differentiated across income groups. It began to climb dramatically in the 1950s and, according to him:

> "By 1965 it had reached the highest level in American history with virtually all groups eating over 200lbs per capita annually. Gains were especially pronounced at the lower socioeconomic levels; urban residents earning less than $3,000 annually still ate 205.2lbs (93.27kg) of meat per year. Income continued to matter, though, as the wealthiest strata of urban Americans consumed almost 50lbs more per person than the lowest income group" (2006: 15-16).

This relationship between rising income and increased meat consumption is now recognised as almost a universal phenomenon, with Bennett's Law describing the shift from starchy staples to more fatty foods as people get richer (Godfray et al 2010). Global dietary patterns are changing as a consequence of complex social and economic processes, including: increased urbanization, greater market penetration by foreign retail and food service chains and brands, the expansion of advertising and mass media, and highly competitive prices. However, this process of Nutrition Transition (Popkin 2005) where western-style highly processed products comprising higher levels of meat intake displace long-established dietary patterns should not be regarded as inevitable or necessarily desirable. Changing diets are also being reflected in changing patterns of body composition as a result of malconsumption (Sage 2012b). As Rayner and Lang (2012) highlight, mass population weight gain and obesity is a worldwide phenomenon that is entirely modern and is adding a new disease burden to health services.

The Production of [Animals for] Meat

> The U.S. Department of Agriculture temporarily closed Hanford-based Central Valley Meat Co. after reviewing video footage from the animal rights group Compassion Over Killing, which said it had captured images of torture and intentional cruelty to cows (*Los Angeles Times*, 22 Aug 2012).

Since the domestication of livestock more than eight thousand years ago, the raising of animals was closely tied to their ability to digest local resources in order to perform

multifunctional roles for farm families. The grazing of crop residues in fields as part of rotations and to avail of manure; the capacity of pigs to root and break up the sod after a long fallow; or the conversion of organic wastes, including human faeces, to meat and eggs were all part of sedentary farming life. Indeed, less than fifty years ago a few pigs and small flock of hens was a visible feature of many European and North American farmyards. However, the progressive elimination of small-scale and multifunctional animal husbandry by the drive to scale economies underpinned by a hygienist regulatory mindset (Marsden 2003) has seen much livestock rearing disappear behind closed doors (and shielded by a strict biosecurity protocol). Together with the reconstitution of animal products into myriad disembodied processed products, this has meant that the visibility of animals has become progressively obscured such that there is little association between the meat on our plate and its origin. As Evan and Miele (2012) observe, the animal is made to not matter within the materiality of the food.

Although livestock husbandry may still support the livelihoods of 600 million poor smallholder farmers in the developing world (Thornton 2010) modern animal production must surely employ many more than that in extended market chains governed by the logic of cost reduction and efficiency. The emergence of grain feeding of animals began in the USA in the 1950s and spread quickly to Europe, the Soviet Union and Japan in the 1960s: suddenly there were no local resource constraints to the number of animals that could be raised. This has had an utterly transformative effect on the production of monogastrics (pigs and poultry), but it has also had a big impact on the cattle sector, with beef and dairy cattle removed from pasture in favour of stall-feeding. Characterised by high stocking densities, confinement practices and measures aimed at 'speeding up' the growth cycle of animals, intensive livestock operations (also known as confined animal feeding operations, CAFOs, or more colloquially as 'factory farms') have come to account for around 40 percent of global meat production by volume, with around three-quarters of the world's poultry meat, 68 percent of egg production and about half of the world's pig meat produced in confined feeding operations (Weis 2007).

Taking a generous view, and notwithstanding the quotation from the *Los Angeles Times* above, it might be argued that modern animal production did not set out to be cruel or wasteful, but to be efficient, to get more output for less input. Above all,

modern methods were designed to reduce labour with other inputs either freely available (air, water) or relatively cheap (energy, feeds) (Gussow 1994). The development of large-scale meat and dairy production offered new opportunities for agro-industrial appropriationism through the supply of: 'balanced' feeds, veterinary medicines, dedicated animal housing units, waste management equipment, and above all, the breeding of higher yielding and faster maturing pigs, chickens and cattle. As Page (1997) describes for the US, the diffusion of capital-intensive techniques resulted in a dramatic reduction in the number of farms raising pigs and a sharp increase in the average number of pigs per farm. The worldwide expansion of intensive livestock operations has been led by the world's largest grain and agribusiness companies and financially supported by the lending policies of the World Bank and the regional development banks. It is this which has enabled China to now account for half of total world pork production (Holt-Giménez and Patel 2009, USDA 2012).

Indeed, perhaps the best illustration of the worldwide expansion of the intensive livestock industry is that India is set to become in 2012 the world's largest exporter of beef. While at first glance this would appear to constitute the clearest transgression of deeply established cultural-religious norms, in fact India's exports exclusively comprise deboned frozen water buffalo (genus *Bubalus).* Though not of the genus *Bos*, the sacred bovine, it is of the same sub-family (*Bovinae*) and is thus regarded as beef within the USDA global estimates of production. In a country where federal law prohibits the slaughter of all cattle, India's export trade in beef (known as *carabeef*) is driven by the slaughter of male and non-milk yielding female water buffalo. While global beef production has levelled off in recent years and estimated at 57 million tonnes in 2012, Indian exports are growing strongly. This is due to the lower price of *carabeef* but also that its production meets halal standards and is therefore expanding in the markets of the Middle East and North Africa and South East Asia (USDA 2012).

The dramatic increase in meat production worldwide has been due to a growth in animal numbers – with 45 percent now in exclusively confined systems – but also to extensive breeding efforts. Today, the carcass weight of broiler chickens is 30 percent heavier than it was thirty or so years ago, with hens laying 25 percent more eggs and cows yielding up to 40 percent more milk. These increases have largely

been achieved through ‘conventional’ breeding techniques which, though stretching back over three centuries, have become an increasingly technical and institutionalized process (Ritvo 2004). Yet crossing varieties to exploit the desirable qualities of different strains, and within breed selection to optimise particular traits, have had significant animal welfare consequences: chickens that cannot support their own weight, cattle that cannot give natural birth to a calf; pigs with weakened skeletal strength, and so on. Yet the rate of genetic change amongst commercial livestock is increasing not only in pursuit of higher productivity, but to achieve other desirable attributes including product quality (eg leaner meat, or with higher levels of Omega-3), disease resistance, or lower environmental impacts (eg methane emissions). It has been argued that a broader spectrum of breeding objectives is likely to facilitate public acceptance of genomic technology which is “likely to revolutionize animal breeding” (Thornton 2010: 2858). In other words, moral anxieties around the development and application of new scientific methods may be offset by claims that the meat is leaner, healthier, more environmentally friendly, and cheaper.

Yet beyond the efforts of conventional or novel breeding tools rest the everyday production practices of intensive livestock farming that are causing growing numbers of people to pause and reflect upon their meat-eating habits. Animal welfare organizations have drawn attention to confinement practices that include the use of cages for battery hens and pens for nursing sows that do not even allow sufficient room to turn; and have highlighted common surgical procedures including debeaking, docking tails, clipping piglets’ teeth, and castration without anaesthetic. In the Netherlands alone, 50 million one day-old male chicks are gassed or shredded alive each year because they serve no useful production purpose (Arts et al 2010). Managing reproduction in pigs can involve surgically relocating a boar’s penis so that it can identify sows in a fertile state but allows the semen to be collected by a handler which can then be carefully allocated in order to artificially inseminate twenty sows. These are all practices that combine to drive down costs of production so that meat can become an ever cheaper food staple (Singer and Mason 2006). It is little wonder that these creatures appear to have lost their sentient character to become much like machines housed in rural factories, and subject to the kinds of everyday cruelty noted in the extract that opened this section.

Although there is a wide spectrum of animal welfare organisations in the UK, stretching from the Royal Society for the Prevention of Cruelty to Animals through to the Animal Liberation Front, persistent lobbying by such as the RSPCA and Compassion in World Farming have done a great deal to raise welfare standards around farmed animals. The creation of a food assurance and labelling scheme such as the RSPCA's Freedom Food[2] seems to have proven a success in the market place with consumer spending on Freedom Food labelled chicken growing for the year from March 2009 from £16.4 million to £71.6 million, compared to a drop of more than £26 million for standard chicken (FCRN 2010).

But it is with regard to environmental impacts that the aggregate effect of meat consumption is drawing growing concern. Livestock now account for over 70 percent of all agricultural land with over one-third of global arable land given over to the production of animal feeds. Only 62 percent of crop production is allocated to human food, with 35 percent to animal feed (Foley et al 2011). The increasing volumes of cereals and oil seeds produced for dedicated use in the animal feeds sector, to be converted into meat and other livestock products, is a matter of growing concern in the context of the prevailing global food security discourse. The oft repeated statement that food output must double to meet an expected population of 9 billion by 2050 has become a powerful framing device and justification for a reinvigorated policy of productivism (Tomlinson 2011, Horlings and Marsden 2011) in which meat is regarded as a vital element. Yet, the pressing question remains: to what extent can western dietary norms be maintained in the West, let alone extended to the rest of the world without imperilling planetary limits?

Re-establishing and transgressing boundaries in meat consumption

In less than 50 years the world has not only achieved a high level of meat consumption: it has cemented almost universal expectations about meat consumption that will be catastrophic to maintain but very hard to change (Roberts 2008). As we have seen, meat consumption practices appear to be closely anchored to cultural traits, even if the quantities consumed are entirely modern. This makes it

[2] Freedom Food provides an audited assurance scheme that animals enjoy five basic freedoms: freedom from fear and distress; freedom from hunger & thirst; freedom from discomfort; freedom from pain, injury and disease; and freedom to express normal behaviour (http://www.ukagriculture.com/food/freedom_food.cfm)

extremely difficult to devise and implement pathways to lower levels of consumption. Supporting and protecting contemporary eating practices are layers of norms that present a formidable defence: notions of consumer sovereignty that provide almost a ‘constitutional right’ for the consumer to eat whatsoever they want, when they want, in quantities they want even if it might hasten their demise. Moreover, to be sure the food industry would spring to the defence of consumer rights for it is the prime beneficiary of refashioned consumption norms and would not allow them to be vulnerable to state-led exhortations to eat less for the sake of the planet.

Peeling back the outer layers of self-interest and consumer rights exposes rather tougher matters: a central axiom that states ‘meat provides the protein and other nutritional requirements needed for a healthy life’. How can a coherent nutritional strategy emerge that clarifies for the majority of people that eating less - or even no - meat does not leave them vulnerable to under-nourishment? And then at the core are cultural assumptions and timeless generalisations about food where meat and other animal products reveal a level of embeddedness that suggests the challenge for change will indeed involve a series of profound cultural and societal transgressions.

Yet as Rayner and Lang (2012) remind us, the Nutrition Transition which has been characterised as a shift in dietary practice across the Global South toward more Western style eating featuring higher levels of meat intake is at root a *cultural* and *societal* transition, not just an eating one. As they say, other forces make this happen: “marketing, logistics, cheap energy and changed lifestyles” (p.211). As an integrating concept the Nutrition Transition has captured the imagination of policy-makers everywhere for it encapsulates the visible phenomenon of heavier bodies. However, fragmentation of responsibility between government ministries poses problems for the kind of holistic and integrated response that the Nutrition Transition requires. Consequently, according to Rayner and Lang, policy initiatives to date have tended to be weak, voluntary and dependent on appeals to consumers to change. Exploring pathways towards less meat-intensive diets – a process of *de-meatification* - nevertheless remains an urgent public and environmental health priority and requires widening the lens of possible policy options and related socio-cultural changes.

What is developed below is a way of considering possible transition pathways toward a future of less meat. It involves a simple three-level typology that ranges from minimal change ('reluctance') through a greater willingness on the part of consumers to engage with reducing meat intake ('flexitarianism') to a third category requiring individuals to transgress culturally prescribed boundaries around eating ('pioneers'). In this regard these three levels are more than merely options for *behavioural* change, but speak to the different requirements for embodied social, cultural and material transgressions. This simple typology has parallels with the three 'routes of transition' described by de Bakker and Dagevos (2012), but theirs is constructed and differentiated by levels of expectations around consumers' willingness to change. Their paper draws upon research findings involving a large-scale consumer survey commissioned by the Dutch Ministry of Agriculture that wished to identify opportunities to promote sustainable protein consumption. Some of their observations regarding possibilities for shaping consumer behaviour are included below. Moreover, I also draw upon Evans and Miele's (2012) argument regarding the connections and disconnections of meat consumption and animal lives and seek to weave this into a consideration of the ways in which consumers might make choices regarding prospects for change.

Reluctance

In their paper, de Bakker and Dagevos label their first Route as 'Sustainability by Stealth'; where food consumers are regarded as fairly passive when it comes to their food, and see no reason to pose difficult questions or make significant changes. As noted earlier, there are strong commitments to meat eating underpinned by a range of justifications: nutrition and health; culture and tradition; enjoyment and indulgence; even masculinity, strength and virility (Buerkle 2012, Lockie et al 1999, Twigg 1983). While de Bakker and Dagevos found in their survey that cultural values around meat are slowly changing, health and nutrition remain significant obstacles to consumers moderating their consumption of meat. As they note, "most consumers in the Netherlands are unaware of the fact that they eat much more animal proteins than

they actually require"[3] and that there is little knowledge that one "could cut down on meat or dairy a few days a week" without putting themselves at nutritional risk (de Bakker and Dagevos 2012:882).

One way in which public policy might look to lead on this process of 'cutting down' on meat for a day or more each week has emerged in the 'Meat Free Mondays' campaign. Building on wartime messages to civilian populations to conserve food for troops serving overseas, the idea of 'Meatless Monday' was resurrected in 2003 as a public health awareness programme in association with the Johns Hopkins Bloomberg School of Public Health and was widely implemented across the Baltimore school system. In May 2009 the Belgian city of Ghent declared Thursday a meat (and fish)-free day, while San Francisco city council made a similar ruling in April 2010. Meat-free days are a potentially powerful tool to capture the public imagination, and the celebrity vegetarian Paul McCartney is the very public face of the *Meat Free Mondays* campaign in the UK and beyond. Nevertheless, while there appears to be some momentum around this international movement, there remain obstacles and opponents who will resist such notions. An example here was the attempt by Brighton and Hove Council to introduce a meat-free Monday in its staff canteens in July 2011. Much to the delight of the vitriolic *Daily Mail*, "a protest was staged by the 'disgusted' workers when their canteen removed bacon butties and lamb chops from the menu" (Daily Mail 29 July 2011).

A category considering minimal levels of change to extant food consumption practices is one where there animals are more likely to be literally absent from consideration. As Evans and Miele (2012) observe, "meat is simply meat, and animals simply do not figure or physically matter" (303). In tracing the basis of this disconnection through focus group discussions as part of their research, Evans and Miele identified a number of practical ways, besides simply wilful denial, that cause this cognitive and material disconnection between animals and foods. These include: the speed and timing of shopping practices, where shopping in a hurry affects attentiveness to food labels; the material presentation of animal foods, where highly

[3] Average EU consumption of animal protein per capita is about twice the global average while the total per-capita protein consumption (including vegetable sources) is about 70% higher than recommended (Westhoek et al. 2011).

processed products (chicken nuggets) invoke little reaction compared to cuts with recognisable features (eyes, face, legs); the backgrounding of animal origins compared to other ethical concerns, such as feeding and nourishing the family and other aspects of care that take priority over animal well-being; and, finally, everyday food vocabularies that disconnect the foods from their animal origins.

Evans and Miele are consequently interested in ways by which animals can be made to matter, though the challenge that they, and others concerned with lowering meat consumption, face is that “eating an animal is an astonishingly smooth and unremarkable practice” (2012: 312). Clearly, maintaining this system requires the production and slaughter of animals to remain out of sight, as well as the deployment of presentational and other devices such as vocabularies to be presented in certain ways. Consequently, raising consciousness or connectedness with animal lives may require making these features more visible which is a challenging prospect. One alternative may be to find ways of providing a meat substitute.

This has been a principle underlying the development and promotion of meat analogue products which are designed to mimic the processed meat equivalents such as burgers, chicken, or mince. The two main meat analogue materials are: textured vegetable protein (TVP) which is derived from soybeans and which is considered high in protein and fibre content; and Quorn, a trademarked mycoprotein product that is low in fat and high in protein and fibre. Both analogues are promoted as ‘healthy options’ with Quorn achieving approval by the Vegetarian Society. However, Quorn has come under sustained scrutiny from the Centre for Science in the Public Interest based in Washington, DC., which has brought two charges against the product. The first is that there has been a relatively high incidence of allergic reaction following consumption with the CSPI documenting cases of consumers experiencing severe symptoms across Europe and Australia as well as the USA. The second charge that CSPI makes is that Marlow Foods, Quorn’s manufacturer, is engaged in misrepresenting it as being mushroom based when it is in fact derived from a fungus, *Fusarium venenatum*. As CSPI argues, “While all mushrooms are fungi, not all fungi are mushrooms” (Manjoo 2002). Indeed, it is worth noting how a ‘healthy’ meat alternative is created in this brief profile:

> "The principal ingredient is a microscopic fungus, Fusarium venenatum, which the company feeds with oxygenated water, glucose, and other nutrients in giant fermentation tanks. Once harvested from the tanks, the material is heat-treated in order to remove its excess RNA, and then dewatered in a centrifuge. Combined with egg albumen and other ingredients, it is then "texturized" into various meat-like shapes" (CSPI 2011)

Ironically, this product was developed from collaboration between two industrial corporations, Rank Hovis McDougall and ICI, at a time during the 1960s when there was fear of a worldwide protein shortage (O'Connell 2009). As the description of the manufacturing process above suggests, this is an industrial product with purely functional attributes; a synthetic material, designed to mimic the texture and flavour of different meats with reduced fat content. There is little that is 'alternative', ethical or 'natural' about its production or consumption. Nevertheless, with its label of approval from the Vegetarian Society and its range of over 100 prepared, largely convenience, products, Quorn might well appeal to meat eaters reluctant to fundamentally change their dietary practices but willing to consider a degree of substitution.

Flexitarianism

In their second route of transition which they label 'moderate involvement', De Bakker and Dagevos (2011) assume a level of engagement by consumers in reducing meat intake through smaller portion size or by regularly incorporating a meatless day which would itself become normalised. They regard this segment of consumers as the major target group capable of reversing the trends in rising levels of meat consumption; the vanguard, if you like, of de-meatification. But how can such a process be encouraged and developed? For De Bakker and Dagevos the challenge is to develop further "meatless or low-meat dinner concepts" and to do so in a way that moves beyond the mere substitution of meat on the plate with meat analogues. In this regard, the normalisation of meatless meals might begin with a campaign led by celebrity chefs as they take on the challenge in their latest television series and accompanying book[4] or include the spread of 'low carbon diet'

[4] In the UK Hugh Fearnley-Whittingstall has been most recently associated with a pan-European movement to promote sustainable fishing and 'ethical' fish eating through his 2011 'Fish Fight' programme, internet petition and Facebook campaign. He has also recently 'gone veggie' through the publication of *River Cottage Veg Every Day!* (2011, Bloomsbury) and a 'coming out' article in the *Guardian* newspaper (Fearnley-Whittingstall, 2011).

books and guides (Ghazi and Lewis, 2007; Lappé 2010). But a more fundamental change is required within the catering and hospitality industry that goes beyond training of kitchen staff and encourages an entire system of mentoring for climate-friendly and sustainable diets.

This category comprises food consumers that remain omnivorous albeit with a sense of trying to make a difference. *Flexitarian* has emerged as a term to describe those who are willing to embrace non-meat meals as part of an 'ecologically balanced' diet. While this might suggest moral ambiguity or a tendency to dietary lapses, this group differs significantly from 'Pioneers' as it is not assumed to possess a coherent and explicit food *ideology* (Twigg 1983, see below) or fixed set of values. Rather, we might regard this group as comprising 'regular people' struggling to do the right thing in a '*meatogenic*' foodscape. Besides, given the evidence that animal husbandry has a major role to play in maintaining sustainable and biodiverse landscapes (Tudge 2003) there is a strong argument that Gussow makes without in any way promoting meat consumption that, "it would be beneficial if everyone were to acknowledge the ecological appropriateness of omnivorousness" (1994: 1115).

The term 'ethical carnivore' might also be associated with this category to refer to consumers who reject factory farming but not meat eating and, again, this might be the result of quite different motivations. For example, a 'flexi-gastronome' may relish the taste and succulence of free-range fresh meat or charcuterie that carries a label of designated origin. The welfare of the animals that provide such products may be of lesser importance than the name or location of the curing enterprise. Secondly, consumers who are worried by tales of antibiotic residues in conventionally-raised meat may, on the other hand, prefer to choose organically labelled products. In both cases the concern is care for oneself rather than care for animals. And third, there are those who search out products that they know to derive from small carefully managed herds or flocks and for which all necessary care has been taken with the creature during its, albeit foreshortened, life. Short food supply chains are a way that

---

For Fearnley-Wittingstall (2011), "we need to eat more vegetables and less flesh because vegetables are the foods that do us the most good and our planet the least harm". The cookbook won *The Observer Food Monthly's* best cookbook award for 2012 given that it has "he has rescued vegetables from vegetarianism" (Anthony, 2012).

consumers can connect directly to such producers. Nevertheless, the charge might be made that flexitarianism simply reinforces self-identity for, as Buller argues, the ethical consumer benefits twice: by acquiring quality food and ethical standing. For him this attempt to build a new food ethics centred upon consumption lacks transformative power (Buller 2010).

Yet, while embracing a range of different motivations, this category of flexitarianism arguably does attempt to make a greater connectedness between the food on the plate and the animals from which it originated and reveals an awareness of other criteria besides those of price and convenience. Here, Evans and Miele suggest that beyond the explicit labelling of 'animal-welfare-friendly' foods there is an effort by consumers "to sense and make sense of the farm animal welfare credentials of their foods (2012: 306). In other words, the texture of meat, the colour of egg yolks and taste become central to connecting with animals. However, the rationale underpinning these connections may be complex and contradictory, with tastes and other desirable markers of food quality demonstrating their culturally, biologically and historically contingent nature (Evans and Miele 2012).

Whether this is sufficient to open up the prospect, following Wolch and Emel (1998: xii; see also Whatmore, 2002) of reintroducing animals to the circle of morality and subjectivity remains uncertain. As Lynn argues:

> "When we speak out for the moral value of animals, we are engaging in boundary transgressions, that is, transgressing the boundaries of our human-centred moral community by demanding the inclusion of animals" (1998: 286).

One group that can be said to have spoken out to some extent on behalf of animals and their welfare is vegetarians, and they open up the third of the transition pathways, labelled 'pioneers'.

Pioneers

This third and final category of hypothetical transition pathways toward a future of less meat considers options that mark more profound transgressions of culturally prescribed boundaries. It is appropriate to begin with an evaluation of the option that simply eschews meat: vegetarianism. Yet vegetarians can be differentiated according to the degree to which they exclude the use of animal products. Lacto-

ovo-vegetarians permit the consumption of dairy and eggs, while vegans seek to eliminate all animal products from their lives, including leather. Due to the widespread use of animal derived ingredients in processed food – for example gelatine is a by-product of the meat and leather industries and is widely used as a setting agent, while rennet used in cheese making was traditionally derived from the stomachs of calves, lambs or kids – vegetarianism requires vigilance. The more individuals construct their identity around the avoidance of animal products, the more clearly does vegetarianism become an explicit food ideology requiring those individuals to "step outside the culturally prescribed forms of eating" (Twigg 1983: 19).

Vegetarian dietary cosmology disrupts and, to some degree, inverts the dominant culture's hierarchy of foods that places meat – especially red meat – at its apex. Such an ordering generally regards cereals and vegetables, fruits and nuts as constituting little more than dietary supplements and largely as ancillary items to the formation of a meal centred upon meat. Vegetarians, in contrast, celebrate the *vitality* of such foods, especially in their most natural state: minimally processed and frequently raw. Indeed, rawness here is valued in much the same way as the dominant culture celebrates cooking, but with no complex cultural mediation required (Twigg 1983). Raw foodism is currently enjoying some popular attention as its health-giving properties are extolled by minor celebrities and kitchen gurus, although it is hard to imagine under prevailing norms how this might become a more widespread feature of contemporary eating.

Nevertheless, the existence of a vegetarian movement – albeit one beset by tensions and cleavages over the respective priority attached to moral goals (animal welfare) as opposed to instrumental personal health considerations (Morris and Kirwan 2012) – might arguably play an important role in holding up a mirror to dominant attitudes to meat. It can raise questions about the values we assign to environmental public goods as compared to the supply of cheap animal products and offer the case for more sustainable dietary ecology. But Western concern with ethical foods largely rests upon offering a highly individualised alternative mode of eating and way of relating to the world (Morris and Kirwan 2012). It does not, for example, do much to address the one billion undernourished primarily in countries of the South

(Buller 2010). Moreover, given the current contribution of the livestock sector to climate change, accounting for around one-fifth of greenhouse gas emissions, as well as other environmental impacts discussed earlier, the projected doubling of meat consumption worldwide arguably makes such behavioural changes as of relatively limited significance in regard to the scale of the changes required.

The reality is that there are enormous disparities in levels of meat consumption worldwide with the most developed countries recording excessive intakes that correlate with high incidence of obesity and cardio-vascular disease. A reduction in the consumption of red meat and animal fat is generally recognised amongst health professionals as likely to result in substantial public health improvements, including lowered incidence of heart disease and colorectal cancer (McMichael et al 2007). In contrast, the “consumption of a small amount of animal-source foods per day in low-consumption populations could help to alleviate the burden of undernutrition” (Friel et al. 2009: 2022), and is thought to play a protective role in reduction of strokes (McMichael et al 2007). Consequently, what is needed in the interests of global justice - on both an inter-generational and intra- generational basis - is a policy framework that would reduce meat consumption in high-income societies to an established ceiling to which low- and middle-income countries would then converge (McMichael et al 2007). This ‘contraction and convergence’ model has been widely discussed as the most equitable framework for greenhouse gas reductions in pursuit of climate stability (Global Commons Institute 2012). Building an effective global policy framework around limits to livestock production and meat consumption equally offers an equitable and truly pioneering initiative, and one that calls for political and moral leadership in public policy.

Building effective governance around a global strategy of convergence will require a host of measures, including technological innovation, economic incentives and significant social and cultural change. Taxation, for example, could prove an important instrument to help shift consumption patterns from red meat to white, and from meat to farmed non-predator fish. Indeed, taxation might extend from environmental externalities (eg based on emissions) to include welfare considerations (Vinnari and Tapio 2012). Technological innovations might equally extend beyond ways of reducing enteric fermentation in ruminants through changing

diets or by improving manure management, to include the development of entirely new meats. This is the prospect offered by current work on *in-vitro* meat.

In-vitro meat, otherwise known as cultured meat, is derived from tissue engineering techniques and involves the growing of animal muscle cells in a nutrient-rich medium. The initial cells may be derived from animal embryo stem cells or from muscle biopsies of live animals, while the medium is composed of cyanobacteria that can be cultivated in ponds. According to the organisation, New Harvest,

> "Cells are capable of multiplying so many times in culture that, in theory, a single cell could be used to produce enough meat to feed the global population for a year. After the cells are multiplied, they are attached to a sponge-like "scaffold" and soaked with nutrients. They may also be mechanically stretched to increase their size and protein content. The resulting cells can then be harvested, seasoned, cooked, and consumed as a boneless, processed meat, such as sausage, hamburger, or chicken nuggets" (New Harvest 2012).

While in-vitro meat is still at an early stage of development, there is considerable optimism about the technological feasibility of scaling up production from the experimental laboratory work currently underway. There are certainly significant claims for its environmental, ethical, safety and nutritional benefits over animal-derived meat. Using life cycle assessment methods on a large-scale production model, Tuomisto and Teixeira de Mattos report that,

> "cultured meat production emits substantially less GHG emissions and requires only a fraction of land and water compared to conventionally produced meat in Europe... (e)nergy requirements are lower compared to beef, sheep and pork, but higher compared to poultry" (2011: 6120).

Naturally, there are no animal welfare or associated ethical concerns as this 'meat' does not require the raising and slaughter of farm animals: it will simply be manufactured in vats in large volumes. What it will also offer is an opportunity for capital to finally shake off the constraints of biological processes, those key stages of life, growth and death that, while they have been speeded up through genetic manipulation, have remained an obstacle to the rapid realisation of profit. While the commercial potential of this food will largely depend upon consumer acceptance, as it falls within the hybrid / meat analogue food category discussed

above, it has the potential to appeal to a wide range of reflexive eaters, including vegetarians, as well as those who may simply be attracted by its low price.

Conclusion

A growing body of scientific evidence suggests that the rising appetite for meat around the world cannot be met without increasing the environmental burden on soils, water, and the climate system. In this regard there are grounds to consider high levels of meat consumption in rich societies as constituting a violation or transgression of an environmental threshold: the maintenance of biospheric integrity. Yet it is clear that simply encouraging voluntary change on the part of consumers is unlikely to achieve the aggregate levels of reductions in environmental impacts required, nor do much to facilitate the emergence of alternative forms of production. It simply does not challenge the prevailing order of the contemporary agri-food system.

Yet while factory farming in the North and middle income countries has resulted in animals being taken off the land and put into cages, pens, stalls and feedlots for the rapid metabolisation of feed into food, in the rest of the world animals still perform multifunctional roles, converting material that humans cannot eat – grass, shrubs, crop residues and other wastes – into human food and providing many more services besides. Moreover, there is a strong case for strengthening access to animal products by poor and middle-income citizens in the South as a means of enhancing their nutritional security. Yet efforts need to be made to reverse the diversion of large volume of cereals into the livestock feed chain, and to encourage more extensive grazing as ecologically appropriate. All of this has to be achieved within a complex social and cultural matrix where meat holds many different and important meanings. Ultimately, there will need to be a wide range of different instruments brought to bear to tackle this multidimensional challenge, including serious engagement from public policy makers, as well as heightened levels of individual responsibility. Inevitability there will be major transgressions of established norms and cultural boundaries including challenges to the sovereign ‘rights’ of consumers and, potentially, the prospect of dietary changes with the introduction of new climate-friendly foods. However, this plays out, it is vital to continue to build an alliance for reconnecting sustainable eating to sustainable agricultural production.

Bibliography

Aarts, N. and 103 others. 2010 Plea for Sustainable Livestock Farming: An End to Organized Irresponsibility. http://www.tierschutz-landwirtschaft.de/NL-1c_Sustainable-Livestock-Farming.pdf (accessed 5 September 2012)

Anthony, A (2012) Observer Food Monthly Awards 2012 Best cookbook: Veg Every Day! by Hugh Fearnley-Whittingstall. http://www.guardian.co.uk/lifeandstyle/2012/oct/21/ofm-awards-hugh-fearnley-interview

Bakker, E. de, Dagevos, H. 2012 Reducing Meat Consumption in Today's Consumer Society: Questioning the Citizen-Consumer Gap. *Journal of Agricultural and Environmental Ethics* 25: 877 – 894.

Buerkle, C.W. 2012 Metrosexuality Can Stuff It: Beef consumption as (Heteromasculine) fortification in *Taking Food Public: Redefining foodways in a changing world*, edited by Williams-Forson, P., Counihan, C. New York: Routledge, pp.251-264.

Buller, H. 2010 Commentary. *Environment and Planning A* 42: 1875 – 1880.

Cannon, G. 1999 Feeding the world a healthy diet, in *The Meat Business: Devouring a hungry planet*, edited by Tansey, G., D'Silva, J. London: Earthscan, pp.103-119.

Carolan, M. 2011 *The Real Cost of Cheap Food*. Abingdon: Earthscan.

Centre for Science in the Public Interest (CSPI) 2011 Quorn's "Mycoprotein" not safe, CSPI tells FDA, again. http://cspinet.org/new/201112011.html (accessed 4 September 2012)

Compassion in World Farming (CIWF) 2008 Global Warning: Climate change and farm animal welfare. Godalming, Surry: CIWF.

Daily Mail 2011 Binmen rebel against 'meat-free Monday' after 'green' council ditch their bacon butties. http://www.dailymail.co.uk/news/article-2020041/Binmen-rebel-meat-free-Monday-green-council-ditch-bacon-butties.html#ixzz2AzkmZgKa (accessed 12 August 2012).

Davidson, A. 2006 The Oxford Companion to Food. Oxford: Oxford University Press

Emel, J., Wolch, J. 1998 Witnessing the Animal Moment. In *Animal Geographies: Place, politics, and identity in the nature-culture borderlands*, edited by Wolch, J., Emel, J. London: Verso, pp.1-24.

Evans, A., Miele, M. 2012 Between food and flesh: how animals are made to matter (and not matter) within food consumption practices. *Environment and Planning D: Society and Space* 2012, volume 30, pages 298 – 314.

Fearnley-Whittingstall, H. 2011. Hugh Fearnley-Whittingstall: the joy of veg. http://www.guardian.co.uk/lifeandstyle/2011/aug/26/hugh-fearnley-whittingstall-vegetables (accessed 15 September 2012).

Food and Agriculture Organisation (FAO) 2009 The State of Food and Agriculture: Livestock in the balance. Rome: FAO

Foley, J. Ramankutty, N., Brauman, K., Cassidy, E., Gerber, J., Johnston, M., Mueller, N., O'Connell, C., Ray, D., West, P., Balzer, C., Bennett, E., Carpenter, S., Hill, J., Monfreda, C., Polasky, S., Rockstro¨m, J., Sheehan,J., Siebert, S., Tilman, D., Zaks, D. 2011. Solutions for a cultivated planet. Nature 478: 337-342.

Food and Climate Research Network (FCRN) 2012 'Major increase in sales of higher welfare chicken' http://www.fcrn.org.uk/research-library/consumption/food/uk-major-increase-sales-higher-welfare-chicken. Accessed 15 April 2012.

Frank, J. 2007 Meat as a bad habit: A case for positive feedback in consumption preferences leading to lock-in. *Review of Social Economy* LXV, 3: 319-348.

Freedom Food 2012 About Freedom Food. http://www.rspca.org.uk/freedomfood (accessed Aug 13 2012)

Friel, S., Dangour, A., Garnett, T., Lock, K., Chalabi, Z., Roberts, I., Butler, A., Butler, C., Waage, J., McMichael, A., Haines, A. 2009 Public health benefits of strategies to reduce greenhouse gas emissions: food and agriculture. *The Lancet* 374: 2016-2025.

Garnett, T. 2011. Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? *Food Policy* 36: S23–S32.

Garnett, T. 2009. Livestock-related greenhouse gas emissions: Impacts and options for policy makers. *Environmental Science and Policy* 12: 491-503.

Ghazi, P., Lewis, R., 2007. The low carbon diet: Wise up, chill out and save the world. London: Short Books.

Global Commons Institute 2012 Contraction and Convergence: Climate justice without vengeance. http://www.gci.org.uk/Documents/endorsements_high_res_.pdf (accessed 5 September 2012).

Godfray, H.C., Crute, I., Haddad, L., Lawrence, D., Muir, J., Nisbett, N., Pretty, J., Robinson, S., Toulmin, C., Whiteley, R. 2010. The future of the global food system. *Philosophical Transactions of the Royal Society, B,*365: 2769-2777.

Goodland, R. And Anhang, J. 2009 Livestock and climate change: What if the key actors in climate change are cows, pigs and chickens? World Watch 22(6): 10-19. http://www.worldwatch.org/node/6294.

Goodman, M., Maye, D., Holloway, L. (2010) 'Guest Editorial' *Environment and Planning A* 42: 1782 –1796.

Gussow, J. D. (1994) 'Ecology and vegetarian considerations: Does environmental responsibility demand the elimination of livestock?', *American Journal of Clinical Nutrition* 59(suppl): 1110-6.

Hawkes, C. 2006. Uneven dietary development: linking the policies and processes of globalization with the nutrition transition, obesity and diet-related chronic diseases. *Globalization and Health* **2,** 4 (www.globalizationandhealth.com/content/2/1/4) open access.

Hinchliffe, S., Allen, J., Lavau, S., Bingham, N. and Carter, S., 2012 'Biosecurity and the topologies of infected life: From borderlines to borderlands', version of 24 May 2012, available at http://www.biosecurity-borderlands.org/research, downloaded on 7 August 2012.

Horlings, L. and Marsden, T. 2011. Towards the real green revolution? Exploring the conceptual dimensions of a new ecological modernisation of agriculture that could 'feed the world'. *Global Environmental Change,* 21*,* 441–452

Horowitz, R. 2006 *Putting Meat on the American Table: Taste, technology, transformation*. Baltimore: Johns Hopkins University Press.

Hugh's Chicken Run http://www.channel4.com/programmes/hughs-chicken-run (accessed Aug 13 2012).

Jamie Saves Our Bacon http://www.jamieoliver.com/bacon/pigtv (accessed Aug 13 2012)

Lappé, A., 2010. Diet for a hot planet: The climate crisis at the end of your fork and what you can do about it. London, Bloomsbury.

Lockie, S., Collie, L., Burch, D., Goss, J. Lawrence, G 1999 'Feed the man meat': Gendered food and theories of consumption, in *Restructuring Global and Regional Agricultures: Transformation in Australasian Agri-Food Economies and Spaces*, edited by Burch, D., Goss, J., Lawrence, G. Ashgate pp255-273.

Los Angeles Times 2012 No recall ordered at shuttered Central Valley slaughterhouse, 22 Aug 2012. **http://latimesblogs.latimes.com/lanow/2012/08/central-valley-meat-usda-slaughterhouse-cows-video-in-n-out.html** (accessed 3 September 2012).

Lynn, W. 1998 Animals, Ethics, and Geography. In *Animal Geographies: Place, politics, and identity in the nature-culture borderlands*, edited by Wolch, J., Emel, J. London: Verso, pp.280-297.

Manjoo, F. 2002 A mushrooming Quorn controversy. Wired, 16 April 2002 www.wired.com/science/discoveries/news/2002/04/51842.

Marsden, T. (2003). *The condition of rural sustainability*. Assen, Netherlands: Royal van Gorcum Press.

McMichael, A., Powles, J., Butler, C., Uauy, R., 2007 Food, livestock production, energy, climate change, and health. *The Lancet* 370: 1253-63.

Meat free Mondays http://www.meatfreemondays.com/

Miele, M. 2011 The taste of happiness: free-range chicken. *Environment and Planning A*, volume 43, pages 2076 – 2090.

Mintz, S., Schlettwein-Gsell, D. 2001 Food Patterns in Agrarian Societies: The 'core-fringe-legume' hypothesis. *Gastronomica: The journal of food and culture* 1, 3:41-52.

Morris, C., Kirwan, J. 2012 Vegetarians: Uninvited, uncomfortable or special guests at the table of the alternative food economy? In *Taking Food Public: Redefining foodways in a changing world*, edited by Williams-Forson, P., Counihan, C. New York: Routledge, pp.542-560.

Neo, H. 2011 Meats, in *Green Food: An A to Z Guide* edited by Mulvaney, D., Robbins, P. London: Sage, pp.298-303.

New Harvest 2012 Meat Substitutes http://www.new-harvest.org/substitutes.htm (accessed 5 September).

Nordgren, A. 2012 Meat and global warming: Impact models, mitigation approaches and ethical aspects. *Environmental Values* 21: 437-457.

O'Connell, S. 2009 'Can we learn to love Quorn?' *The Independent,* 8 January http://www.independent.co.uk/life-style/food-and-drink/features/can-we-learn-to-love-quorn-1231757.html (accessed 19 August 2012)

Page, B. (1997) 'Restructuring pork production, remaking rural Iowa', in D. Goodman, M. Watts (eds) *Globalising Food: Agrarian questions and global restructuring*, London: Routledge, 133-157.

Pimentel, D. and Pimentel, M. (2003) 'Sustainability of meat-based and plant-based diets and the environment', *American Journal of Clinical Nutrition* 78 (suppl): 660-663.

Popkin, B. (2005) 'Using research on the obesity pandemic as a guide to a unified vision of nutrition', *Public Health Nutrition* 8(6A): 724-729.

Rayner, G., Lang, T. 2012 Ecological Public Health: Reshaping the conditions for good health. Abingdon: Routledge

Ritvo, H. 2004 Animal Planet. Environmental History, 9: 204-220.

Roberts, P. 2008 The End of Food: The coming crisis in the world food industry. London: Bloomsbury.

Sage, C. 2012a. *Environment and Food*. Abingdon: Routledge.

Sage, C. 2012b. The interconnected challenges for food security from a food regimes perspective: Energy, climate and malconsumption. Journal of Rural Studies doi; 10.1016/j.rurstud. 2012.02.005.

Stehfest, E., Bouwman, L., van Vuuren, D., den Elzen, M., Eickhout, B., Kabat, P. 2009 Climate benefits of changing diet. *Climatic Change* 95: 83-102.

Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M., Haan, C. de (2006) *Livestock's Long Shadow*. Rome: Food and Agriculture Organisation, available at: http://www.fao.org/docrep/010/a0701e/a0701e00.HTM

Stokstad, E. (2010) 'Could less meat mean more food?' *Science*, 12 February, 810-811.

Thornton, P. 2010 Livestock production: Recent trends, future prospects. *Philosophical Transactions of the Royal Society B*, 365: 2853-2867.

Tomlinson, I. 2011 Doubling food production to feed the 9 billion: A critical perspective on a key discourse of food security in the UK. *Journal of Rural Studies* doi; 10.1016/j.rurstud.2011.09.001.

Tudge, C. 2003 *So Shall We Reap: What's gone wrong with the world's food and how to fix it*, London: Penguin Books.

Tukker, A., Huppes, G., Guinée, J., Heijungs, R., de Koning, A., van Oers, L., Suh, S., Geerken, T., Van Holderbeke, M., Jansen, B. & Nielsen, P. (2006) *Environmental impact of products (EIPRO): analysis of the life cycle environmental impacts related to the total final consumption of the EU25*. IPTS/ESTO, European Commission Joint Research Centre, Brussels.

Tuomisto, H., Teixeira de Mattos, J. 2011 Environmental impacts of cultured meat production. Environmental Science and Technology 45: 6117-6123.

Twigg, J. 1983 Vegetarianism and the meanings of meat, in The Sociology of Food and Eating: Essays on the sociological significance of food, edited by Murcott, A. Aldershot: Gower, pp.18-30.

United States Department of Agriculture 2012 Livestock and Poultry: World markets and trade. Foreign Agricultural Service, USDA, April.

Vinnari and Tapio 2012 Sustainability of Diets: From concepts to governance. *Ecological Economics* 74: 46-54.

Weis 2007. *The Global Food Economy: The battle for the future of farming*. London: Zed Books.

Westhoek, H., Rood,T., van den Berg, M., Janse,J., Nijdam,D., Reudink, M., Stehfest, E. (2011), The Protein Puzzle: The consumption and production of meat, dairy and fish in the European Union, The Hague: PBL Netherlands Environmental Assessment Agency

Whatmore, S., 2002. *Hybrid geographies: Natures, cultures, spaces*. London, Sage.